CLAIMS

What is claimed is:

1. A device based on a parametric process involving first and second frequencies ω_1 and ω_2 that differ, the device comprising:

an optical fiber comprising a core and a cladding, the optical fiber being poled with a non-linearity profile having a period that satisfies a quasi phase matching (QPM) condition including the first and second frequencies,

wherein the cladding of the optical fiber comprises a hole structure for providing waveguiding confinement of at least one optical mode in the core.

2. A device according to claim 1, wherein the hole structure dimensioned and arranged to provide a bandwidth BW of at least 5, 10, 20 or 50 nanometers per ten centimeter length of the holey fiber.

3. A device according to claim 1, wherein the hole structure dimensioned and arranged to provide single mode operation at both the first frequency ω_1 and the second frequency ω_2.

4. A device according to claim 1, wherein the hole structure dimensioned and arranged to provide an effective area of the fundamental mode of less than 30, 25, 20 or 15 μm^2.

5. A device according to claim 1, wherein the first frequency ω_1 is greater than the second frequency ω_2 by at least one of 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80% and 90%.

6. A device according to claim 1, wherein the first frequency ω_1 is greater than the second frequency ω_2 in terms of wavelength by at least one of 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9 and 1.0 microns.

7. A device according to claim 1, wherein the parametric process is parametric down conversion (PDC).

8. A device according to claim 1, wherein the first frequency is twice the second frequency $\omega_1 = 2\omega_2 \equiv \omega_0$.

9. A device according to claim 8, wherein the parametric process is second harmonic generation (SHG).

10. A device according to claim 1, wherein the first frequency is approximately equal to, but different from, the second frequency $\omega_1 \sim \omega_2 \sim \omega_0$.

11. A device according to claim 1, wherein the hole structure comprises a plurality of inner holes arranged radially within a plurality of outer holes, the inner holes having a characteristic hole size that is different from that of the outer holes.

12. A device according to claim 11, wherein the inner holes are arranged in the optical fiber around a solid core.

13. A device according to claim 1, wherein the hole structure is arranged within an inner cane, and wherein the inner cane is supported by a plurality of outer canes arranged around the inner cane.

14. A device according to claim 13, further comprising first and second electrodes arranged in respective first and second ones of the outer canes so as to straddle the inner cane.

15. A method of fabricating a device based on a parametric process involving first and second frequencies ω_1 and ω_2 that differ, the method comprising:

providing an optical fiber having a hole structure;

poling the optical fiber to generate a non-linearity profile having a period that satisfies a quasi phase matching (QPM) condition including the first and second frequencies.

16. A method according to claim 15, wherein the poling comprises:

thermal poling of the optical fiber to generate a non-linearity therealong;

placing a mask adjacent to the optical fiber; and

exposing the optical fiber with UV light through the mask to selectively erase the non-linearity along the waveguide structure thereby to generate the non-linearity profile having the period that satisfies the QPM condition.

17. A method according to claim 16, wherein the mask is an amplitude mask, a phase mask or a phase and amplitude mask.

18. A method according to claim 16, wherein the thermal poling comprises maintaining the optical fiber at an elevated temperature while applying an electric field across the hole structure using first and second electrodes arranged to straddle the hole structure.

19. A method according to claim 18, wherein the electrodes are integral with the optical fiber.